



# Seasonal climate forecasts for the renewable energy sector

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Seasonal-to-decadal climate Prediction for the  
improvement of European Climate Services

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## **Motivation**

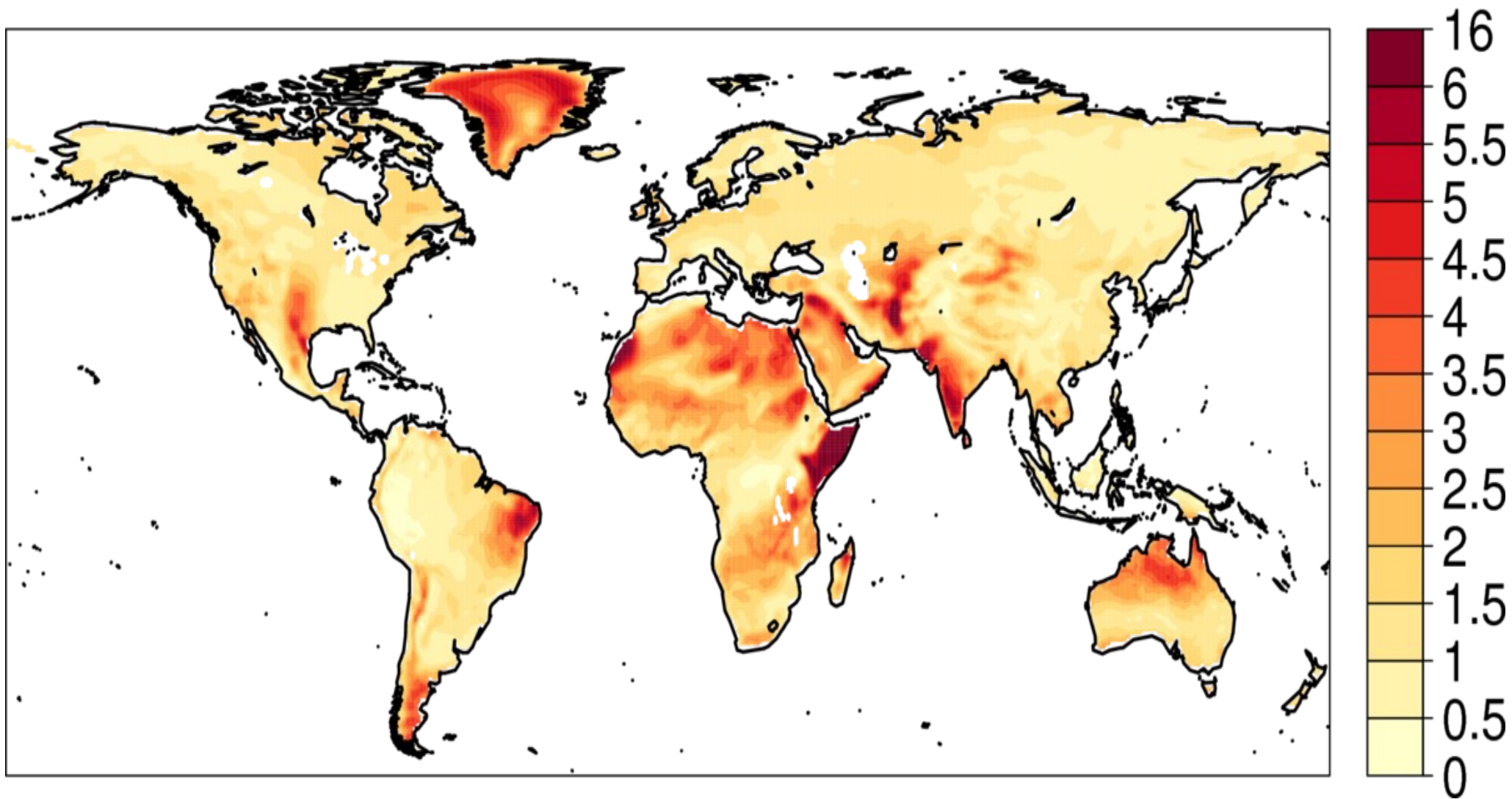
Wind energy sector uses weather forecasts for power generation planning of next few days

Climate forecast information of wind speed for coming months beyond weather useful for grid operators

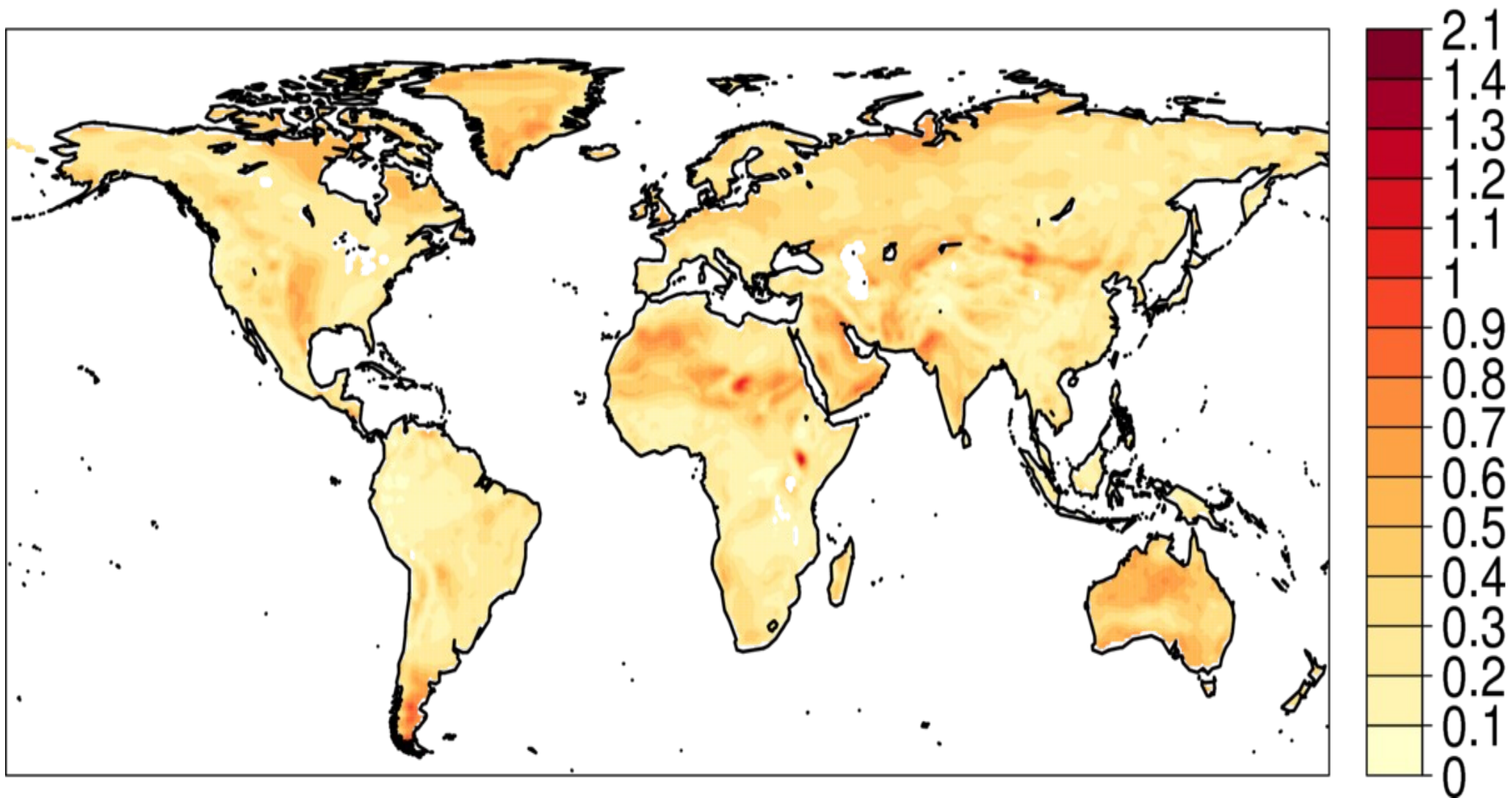
## **Introduction**

Current operational seasonal climate forecast systems produce forecasts of the coming few months

They employ global climate models that have limited horizontal resolution

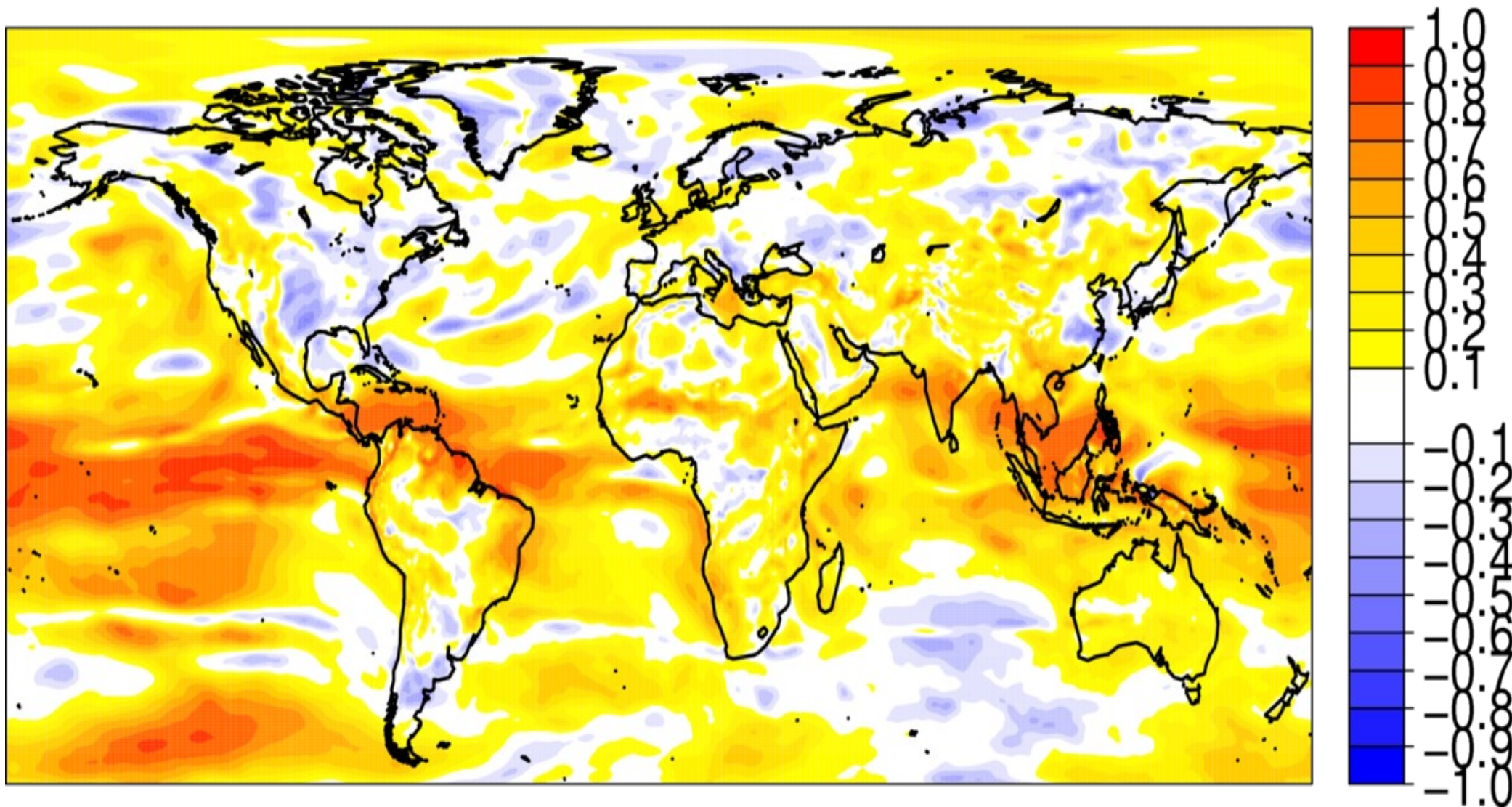


**JJA 10-metre wind speed climatology (1981-2011) in ERA-Interim (m/s)**  
Seasonal mean



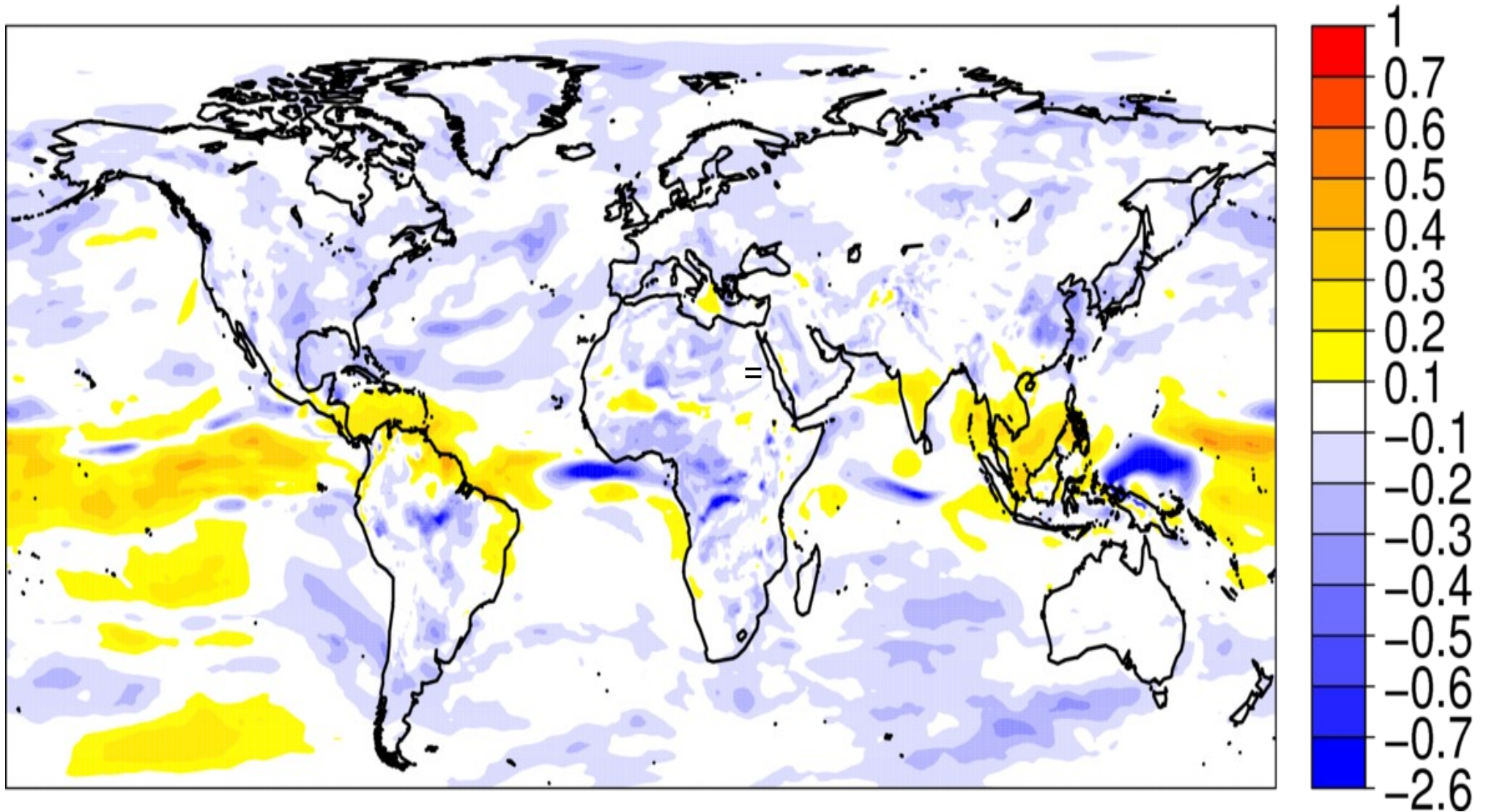
**JJA 10-metre wind speed variation (1981-2011) in ERA-Interim (m/s)**  
Interannual standard deviation of seasonal means





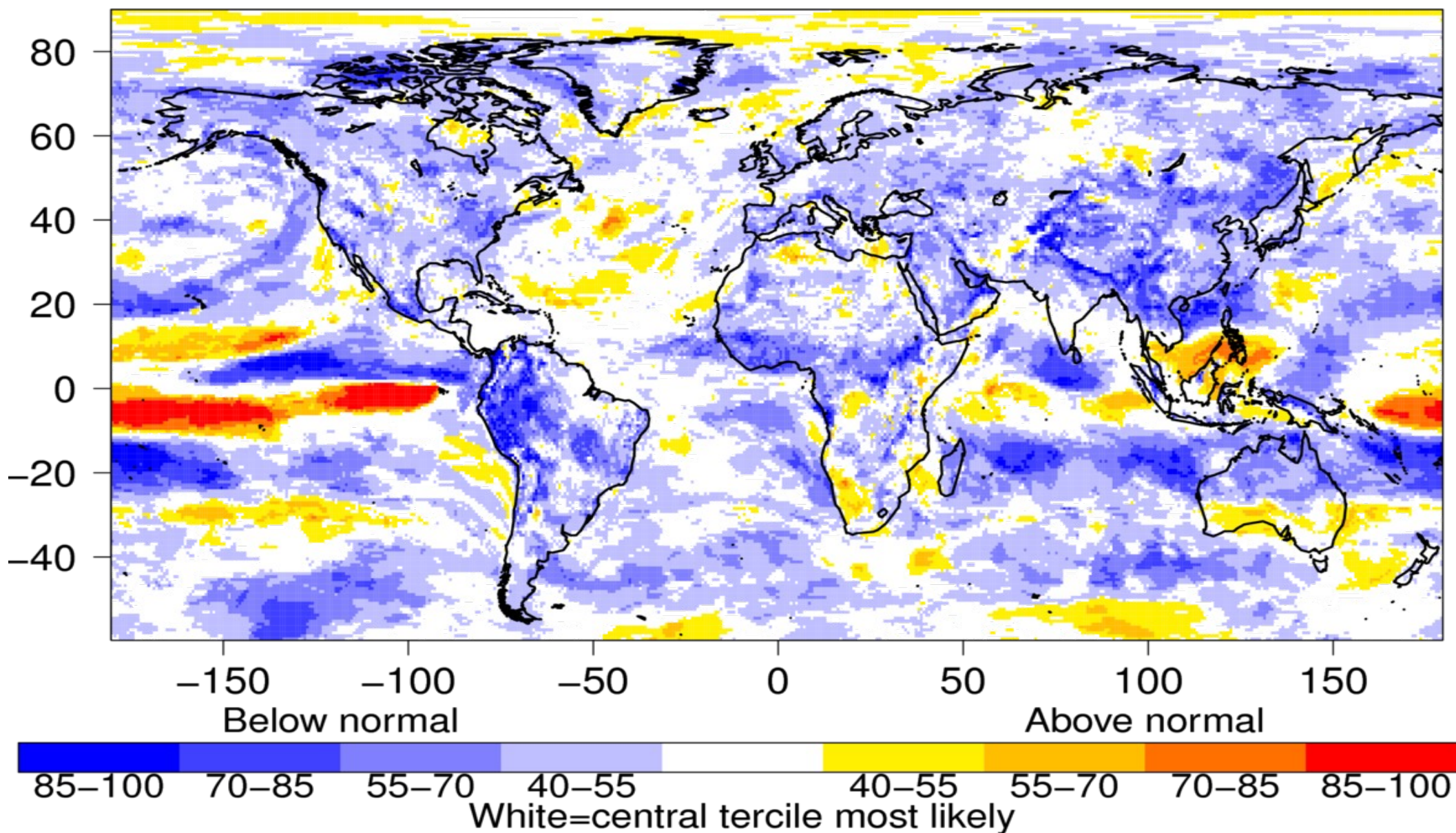
**JJA 10-metre wind speed anomaly verification (1981-2010) for May started forecasts**  
Correlation skill of ensemble-mean





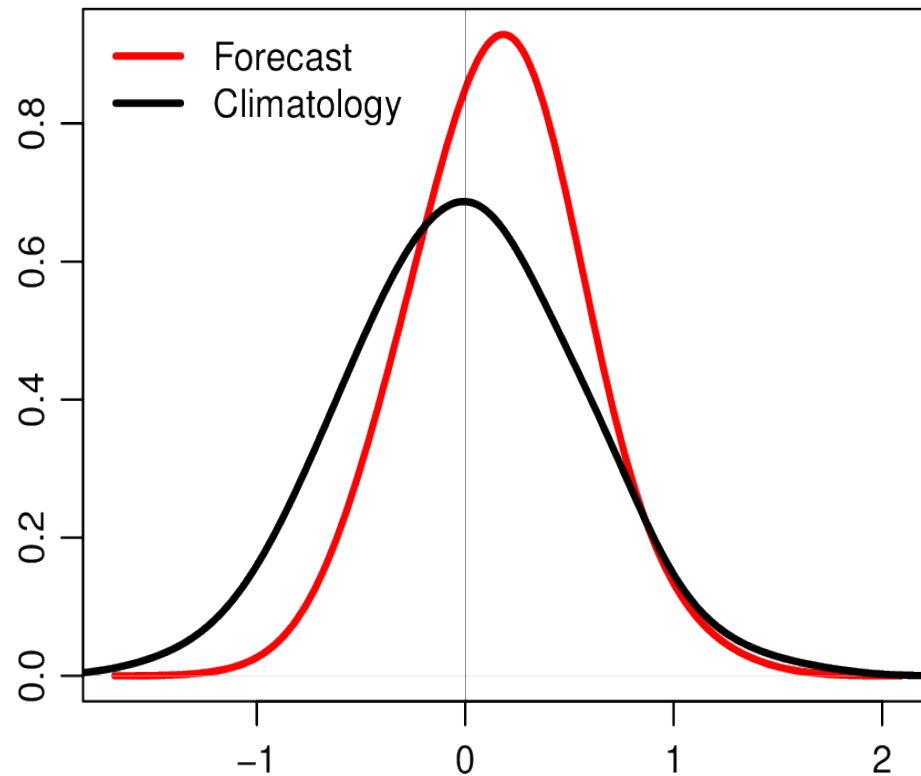
**JJA 10-metre wind speed anomaly verification (1981-2010) for May started forecasts**  
CRPSS of ensemble forecasts





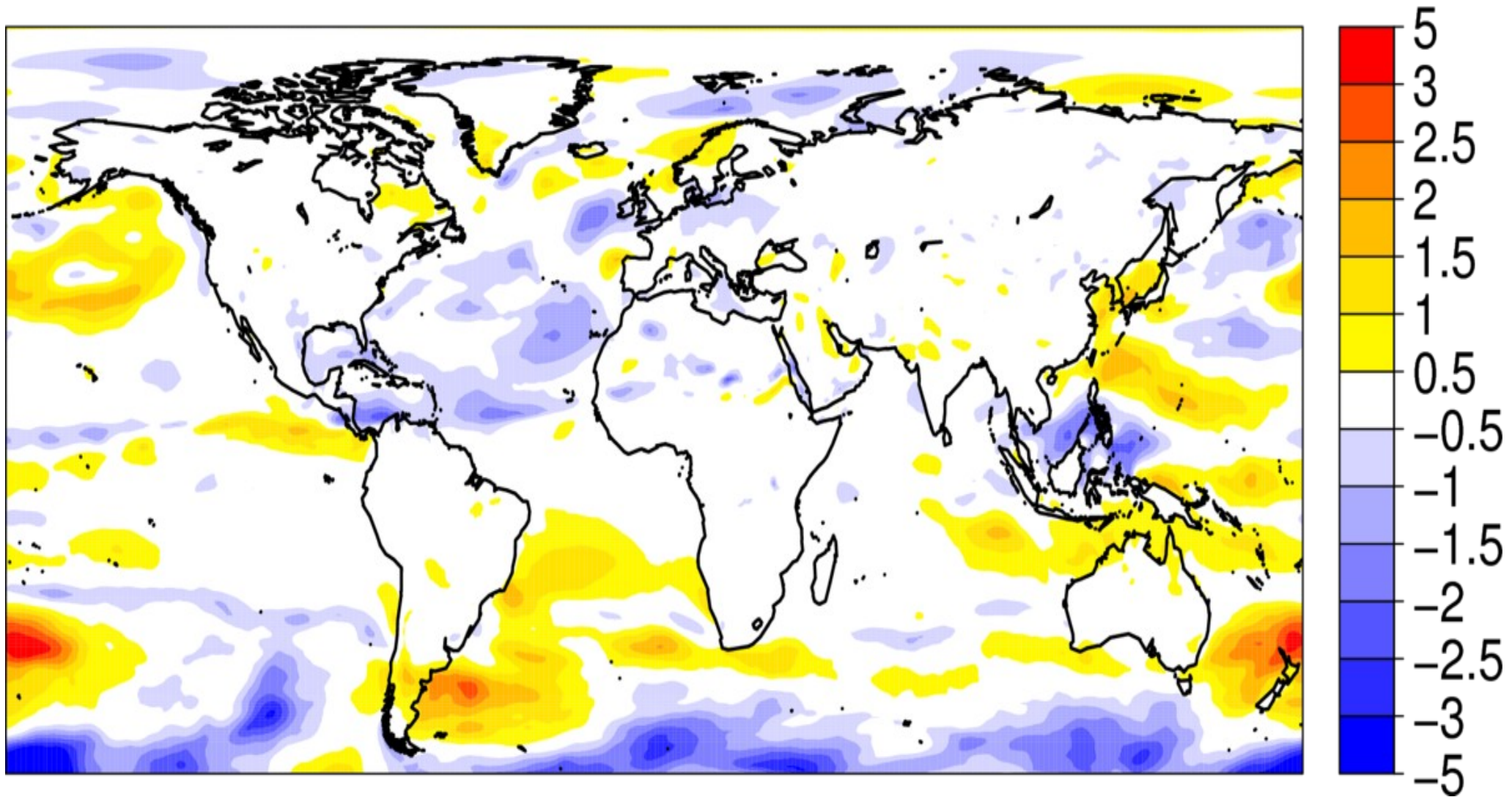
**Probability forecast of 10-metre wind speed most likely tercile (%) from 1-month lead  
JJA 2011 forecasts for May started forecasts**

India wind forecast normal PDF JJA 2011

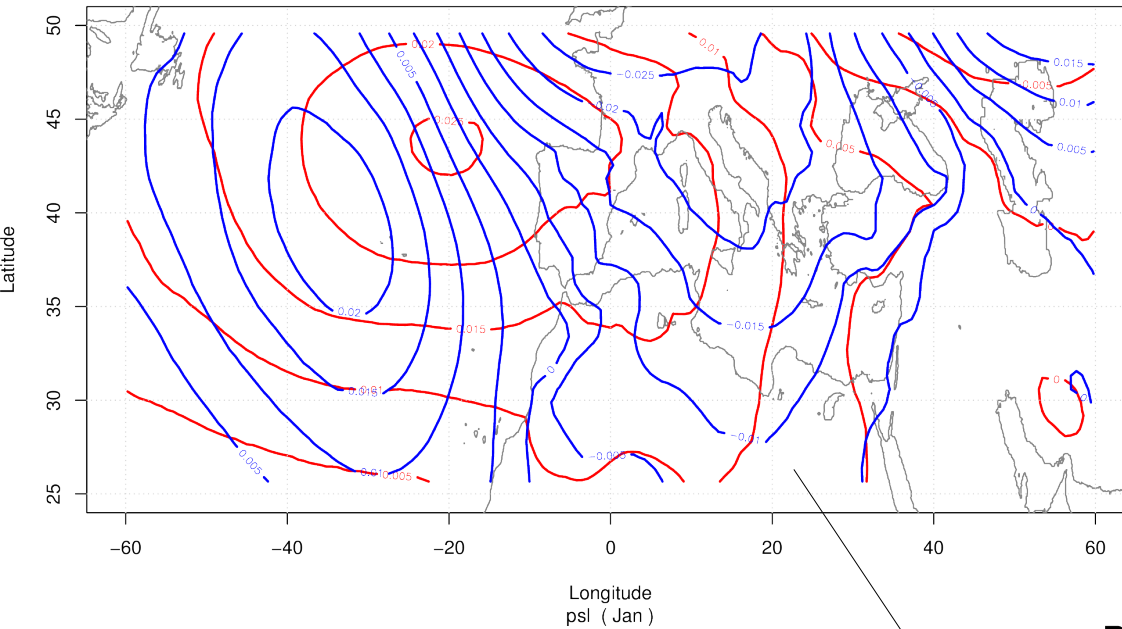


**Probability forecast of 10-metre wind speed from 1-month lead JJA 2011 forecasts for May started forecasts in India**





**JJA 10-metre wind speed anomaly 2011 in ERA-Interim (m/s)**

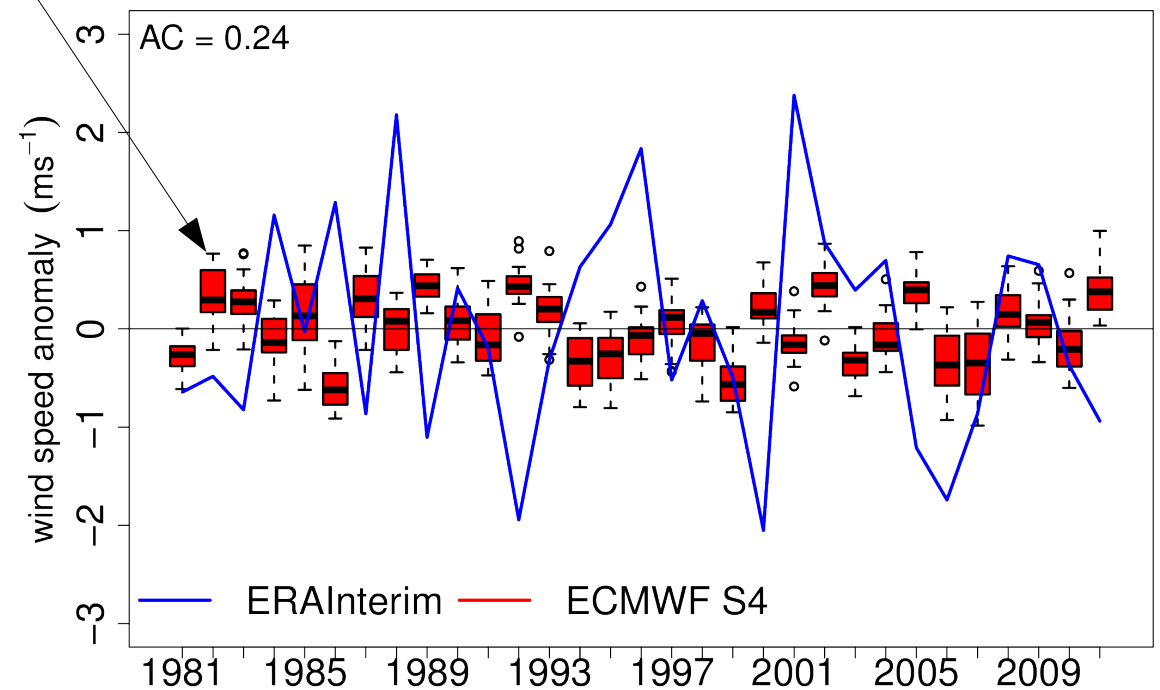


**Downscaled 10-metre wind speed anomaly using information on large-scale atmospheric circulation**

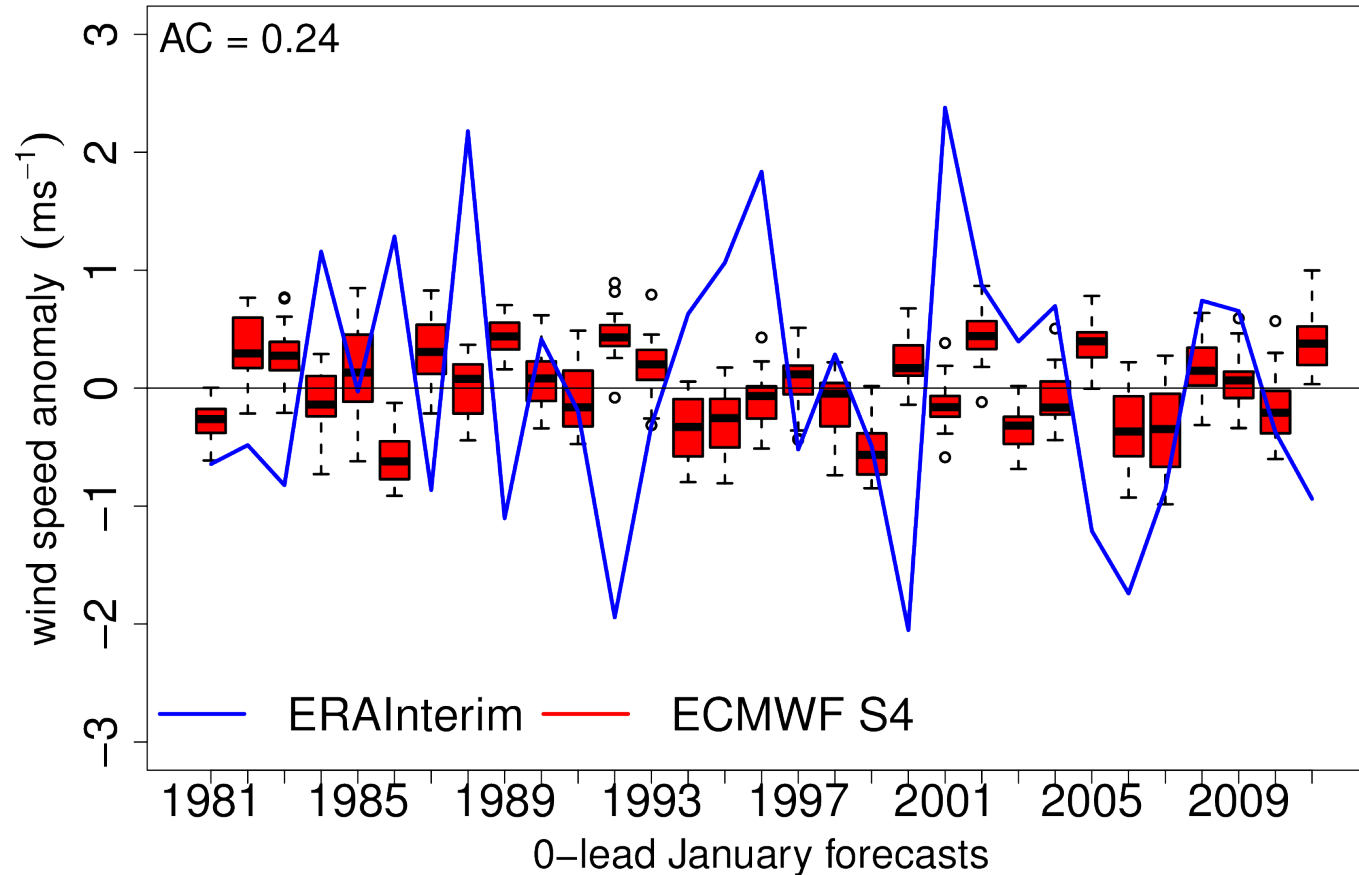
Leading 4 EOFs of sea level pressure in January

**to estimate monthly wind speed at wind farm location in north-west Spain**  
(red, downscaled estimate; black, observation)

**Palencia, Spain Jan 10-metre wind speed anomaly**



## Palencia, Spain Jan 10-metre wind speed anomaly



**Predictor ECMWF S4 Jan SLP**  
**Jan started forecasts**

**Downscaled 10-metre wind speed anomaly using information on large-scale atmospheric circulation (leading 4 EOFs of Jan sea level pressure anomalies) to estimate monthly wind speed at wind farm location in north-west Spain**

**Predictor ERA-Interim Jan SLP correlation = 0.8**



## Summary

- Seasonal climate forecasts (1-month lead) for 10-metre wind speed skillful in some tropical regions (e.g., JJA in India) of direct model output.
- No skill in direct model output of seasonal climate forecasts for 10-metre wind speed in north-east Spain.
- No skill in downscaled Jan 10-metre wind speed in north-eastern Spain when using main sea level pressure modes from Jan started forecasts.
- On the other hand, downscaling of Jan 10-metre wind speed in north-eastern Spain using observed main sea level pressure modes close to the observed.
- Skillful forecasts of main sea level pressure modes could predict wind speed in north-eastern Spain.

## Advancing Renewable Energy with Climate Service (ARECS)

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Forecasting wind and solar variability over future seasons, years and decades  
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Wind Forecasts

Solar Forecasts

It is currently unknown how much the climate could vary from one month, season, year or decade to the next. Throughout the life of a renewable energy

ARECS will minimise the uncertainty of climate forecasting for the energy sector, in order to manage the climatic risks via new tools, and maximise the



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